No. 9400115

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Coors Brewing Company

Whereas, THERE HAS BEEN PRESENTED TO THE

Secretary of Agriculture

AN APPLICATION REQUESTING A CERTIFICATE OF PROTECTION FOR AN ALLEGED DISTINCT VARIETY OF SEXUALLY REPRODUCED, OR TUBER PROPAGATED, PLANT, THE NAME AND DESCRIPTION OF WHICH ARE CONTAINED IN THE APPLICATION AND EXHIBITS, A COPY OF WHICH IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED HAVE BEEN COMPLIED WITH, AND THE TITLE THERETO IS, FROM THE RECORDS OF THE PLANT VARIETY PROTECTION OFFICE, IN THE APPLICANT(S) INDICATED IN THE SAID COPY, AND WHEREAS, UPON DUE EXAMINATION MADE, THE SAID APPLICANT(S) IS (ARE) ADJUDGED TO BE ENTITLED TO A CERTIFICATE OF PLANT VARIETY PROTECTION UNDER THE LAW.

NOW, THEREFORE, THIS CERTIFICATE OF PLANT VARIETY PROTECTION IS TO GRANT UNTO THE SAID APPLICANT(S) AND THE SUCCESSORS, HEIRS OR ASSIGNS OF THE SAID APPLICANT(S) FOR THE TERM OF TWENTY YEARS FROM THE DATE OF THIS GRANT, SUBJECT TO THE PAYMENT OF THE REQUIRED FEES AND PERIODIC REPLENISHMENT OF VIABLE BASIC SEED OF THE VARIETY IN A PUBLIC REPOSITORY AS PROVIDED BY LAW, THE RIGHT TO EXCLUDE OTHERS FROM SELLING THE VARIETY, OR OFFERING IT FOR SALE, OR REPRODUCING IT, OR IMPORTING IT, OR EXPORTING IT, OR CONDITIONING IT FOR PROPAGATION, OR STORING IT FOR ANY OF THE ABOVE PURPOSES, OR USING IT IN PRODUCING A HYBRID OR DIFFERENT VARIETY THEREFROM, TO THE EXTENT PROVIDED BY THE PLANT VARIETY PROTECTION ACT. IN THE UNITED STATES SEED OF THIS VARIETY (1) SHALL BE SOLD BY VARIETY NAME ONLY AS A CLASS OF CERTIFIED SEED AND (2) SHALL CONFORM TO THE NUMBER OF GENERATIONS SPECIFIED BY THE OWNER OF THE RIGHTS. (84 STAT. 1542, AS AMENDED, 7 U.S.C. 2321 ET SEQ.)

BARLEY

'Moravian 14'

In Testimony Whereof, *I have hereunto set my hand and caused the seal of the* Plant Variety Protection Office *to be affixed at the City of Washington, D.C. this twenty-ninth day of February in the year of our Lord one thousand nine hundred and ninety-six.*

Attest:

Commissioner
Plant Variety Protection Office
Agricultural Marketing Service

Secretary of Agriculture

REPRODUCE LOCALLY. *Include form number and edition date on all reproductions.* OMB APPROVED NO. 0581-0055

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE DIVISION

APPLICATION FOR PLANT VARIETY PROTECTION CERTIFICATE

(INSTRUCTIONS ON REVERSE)

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426)

1. NAME OF APPLICANT(S) (as it is to appear on the Certificate)
Coors Brewing Company

2 TEMPORARY DESIGNATION OR EXPERIMENTAL NO.
C-14

3. VARIETY NAME
Moravian 14 AAA 31 Oct 1995 per letter

4. ADDRESS (street and no. or R.F.D. no., city, state, and ZIP)
12th and Ford Street
Golden, CO 80401

5. PHONE (include area code)
(303) 279-6565

FOR OFFICIAL USE ONLY

PVPO NUMBER
9400115

FILING
Date: Feb. 08, 1994
Time: ☐ A.M. ☐ P.M.

FEES RECEIVED
Filing and Examination Fee: $ 2,325.00
Date: Feb. 08, 1994
Certificate Fee: $ 300.00
Date: 02/14/96

6. GENUS AND SPECIES NAME
Hordeum vulgare L.

7 FAMILY NAME *(Botanical)*
Gramineae

8. CROP KIND NAME *(Common Name)*
2-Row Spring Malting Barley

9. DATE OF DETERMINATION
8/1/87

10. IF THE APPLICANT NAMED IS NOT A "PERSON," GIVE FORM OF ORGANIZATION (Corporation, partnership, association, etc.)
Corporation

11. IF INCORPORATED, GIVE STATE OF INCORPORATION
Colorado

12. DATE OF INCORPORATION
June 12, 1913

13. NAME AND ADDRESS OF APPLICANT REPRESENTATIVE(S), IF ANY, TO SERVE IN THIS APPLICATION AND RECEIVE ALL PAPERS
Jay K. Malkin
KLAAS, LAW, O'MEARA & MALKIN, P.C.
1999 Broadway, Suite 2225
Denver, CO 80202

PHONE (include area code): (303) 298-9888

14. CHECK APPROPRIATE BOX FOR EACH ATTACHMENT SUBMITTED *(Follow INSTRUCTIONS on reverse)*
- a. ☒ Exhibit A, Origin and Breeding History of the Variety
- b. ☒ Exhibit B, Novelty Statement
- c. ☒ Exhibit C, Objective Description of Variety
- d. ☒ Exhibit D, Additional Description of Variety
- e. ☒ Exhibit E, Statement of the Basis of Applicant's Ownership
- f. ☒ Seed Sample (2,500 viable untreated seeds). Date Seed Sample mailed to Plant Variety Protection Office February 7, 1994
- g. ☒ Filing and Examination Fee ($2,325) made payable to "Treasurer of the United States"

15. DOES THE APPLICANT(S) SPECIFY THAT SEED OF THIS VARIETY BE SOLD BY VARIETY NAME ONLY AS A CLASS OF CERTIFIED SEED? *(See section 83(a) of the Plant Variety Protection Act)* ☒ YES *(If "YES," answer items 16 and 17 below)* ☐ NO *(If "NO," skip to item 18 below)*

16. DOES THE APPLICANT(S) SPECIFY THAT THIS VARIETY BE LIMITED AS TO NUMBER OF GENERATIONS?
☐ YES ☒ NO

17. IF "YES" TO ITEM 16, WHICH CLASSES OF PRODUCTION BEYOND BREEDER SEED?
☐ FOUNDATION ☐ REGISTERED ☐ CERTIFIED

18. DID THE APPLICANT(S) PREVIOUSLY FILE FOR PROTECTION OF THE VARIETY IN THE U.S.?
☐ YES (If "YES," through ☐ Plant Variety Protection Act ☐ Patent Act. Give date: _____).
☒ NO

19. HAS THE VARIETY BEEN RELEASED, USED, OFFERED FOR SALE, OR MARKETED IN THE U.S. OR OTHER COUNTRIES?
☐ YES (If "YES," GIVE NAMES OF COUNTRIES AND DATES) _____
☒ NO

20. The applicant(s) declare(s) that a viable sample of basic seeds of this variety will be furnished with the application and will be replenished upon request in accordance with such regulations as may be applicable.

The undersigned applicant(s) is (are) the owner(s) of this sexually reproduced novel plant variety, and believe(s) that the variety is distinct, uniform, and stable as required in section 41, and is entitled to protection under the provisions of section 42 of the Plant Variety Protection Act.

Applicant(s) is (are) informed that false representation herein can jeopardize protection and result in penalties.

SIGNATURE OF APPLICANT (Owner(s))	CAPACITY OR TITLE	DATE
Hugo Patino *Hugo Patino*	Vice President- Research and Dev. & Int'l. Brewing	February 4, 1994
SIGNATURE OF APPLICANT (Owner(s))	CAPACITY OR TITLE	DATE

SD-470 (06-93) *Editions of Forms LS-470 (3/86) and CSSD-470 (5/89) are to be destroyed.*

CONTINUED ON REVERSE

EXHIBIT A

Origin and Breeding History of Variety ~~C-14~~ 'moravian 14'

per letter MAH 10-31-95

1. Genealogy:

(a) Cross breeding and selection of the variety (temporarily designated herein and in the other attached Exhibits as "C-14") was performed by Berry J. Treat, Jody L. Treat, Paul A. Krumm, James M. Jakicic, and David J. Gebhardt while employed by the Applicant (Coors Brewing Company) beginning on January 21, 1985.

(b) The origin of C-14 is as follows:

C-14 origin = Gimpel(female) x Nairn (Male)

Gimpel parentage:

(Proctor x Carlsberg II) x (Heine 4808 x Stamm.vL-P) -- Breeder: F. Von Lochow - Petkus G.M.B.H., Germany

Nairn parentage:

Triumph x HB-855(winter) x 467 x 8 -- Breeder: Svalof AB of Svalov, Sweden.

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2. Selection of ~~C-14~~ 'Moravian 14'

per letter M4H 10-31-95

(a) F1 seeds from the Gimpel x Nairn cross were sent to the Department of Agronomy at Colorado State University (Ft. Collins, CO) during the spring of 1985 for the production of double haploid seed lines. It should be noted that variety C-14 as described herein will, to the best of Applicant's knowledge, be the first double haploid barley variety released in the United States. This will result in a high degree of kernel and plant uniformity, as well as identical genetic cloning from generation to generation.

Each seed was processed to produce double haploid lines using a known method in which the C-14 F1 hybrid was pollinated with Hordeum bulbosum, followed by the recovery of haploid embryos therefrom. This method is described in Kasha, K. J., et al., "Haploidy for Rapid Variety and Pure Line Production in Breeding", Notes on Agriculture, pp. 6 - 7 (June 1979); and Thiebaut, J., et al., "Influence of plant development stage, temperature, and plant hormones on chromosome doubling of barley haploids using colchicine", Can. J. Bot., 57:480 - 183 (1978), both of which are attached hereto as Exhibits A-1 and A-2, respectively. The embryos were then cultured and grown to produce haploid plants. During the tillering stage, the plants were treated with colchicine to double the chromosome number. Accordingly, fertile double haploid seed was produced and harvested. The resulting F1 progeny from each plant were genotypically identical and uniform.

(b) Eighteen double haploid lines (F1) were thereafter planted in New Zealand in October of 1986 for seed increase. They were harvested in February of 1987 and yielded approximately one pound of seed.

(c) Eighteen double haploid lines (F2) were then planted in field observation plots at the Coors Malting Barley Research Center in Burley ID in the spring of 1987. As a result, a uniform and pure line preliminarily designated as "DH85-37-1" (later renamed "~~C-14~~ 'Moravian 14'") was bulk harvested and selected as a superior line based on appearance, yield, and quality information. per letter MAH 10-31-95

(d) The F3 double haploid seed of DH85-37-1 listed above in paragraph (c) was planted in regional replicated variety trials in Idaho and Colorado in 1988. Statistical data was collected on agronomic and malting characteristics.

(e) F4 seed of DH85-37-1 was planted in breeders seed increases in April of 1989 and maintained as pure seed in August of 1989. Additional regional variety trials in Burley ID were also conducted to evaluate the performance of C-14 against standard varieties (e.g. Moravian III and Triumph).

(f) One acre of F5 Breeders Seed was planted in 1990 at Burley ID. Following harvest, a portion of the seed was evaluated for malting quality at Applicant's pilot brewing facility in Golden CO. The variety was then renamed from DH85-37-1 to C-14.

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per letter MAH 10-31-95

(g) F6 Breeders Seed of variety ~~C-14~~ 'Moravian 14' was planted at Burley ID in 1991 and certified by the Idaho Crop Improvement Association (hereinafter "ICIA") as Foundation Seed in December of 1991. Field inspections by the Coors Brewing Company (Applicant) and the ICIA verified the uniformity and stability of variety C-14. No variants to variety C-14 were found in the growout.

The selection criteria for C-14 were generally based on agronomic and malting-brewing performance, with the specific selection criteria of concern being as follows: (1) high yield; (2) early maturity; (3) seed uniformity; (4) malting quality; (5) beer flavor; and (6) lodging resistance.

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EXHIBIT B

Novelty Statement

per letter MAH 10-31-95

Variety ~~C-14~~ 'Moravian 14' is most similar to the spring barley variety Galena. However, it is distinguishable from Galena and other commonly-grown barley varieties (e.g. Triumph and Moravian III) by the following morphological characteristics:

1) C-14 heads emerge from the boot earlier than Galena, Triumph, and Moravian III.

2) C-14 is shorter in plant height than Galena, Triumph, and Moravian III.

3) C-14 grain seed length is shorter than Galena, Triumph, and Moravian III.

4) C-14 grain seed area is smaller than Galena, Triumph, and Moravian III.

Supporting data with respect to the foregoing morphological differences is provided in Table 1 as follows:

TABLE 1

Variety	Head Date (days)	Plant Height (inches)	Seed Length (mm)	Seed Area (mm^2)
~~C-14~~ 'Moravian 14'	68	28	7.5	18.3
Galena	75	31	8.2	20.2
Moravian III	71	35	7.8	19.0
Triumph	75	30	8.1	20.0
LSD* @ 0.05 (N=8)	1	2	0.23	0.54

*LSD is a common statistical analysis term known as "least significant difference". Also, all data set forth above in Table 1 was derived from variety performance trials conducted in 1992 at Burley ID and Idaho Falls ID.

In accordance with the foregoing data, the novelty of C-14 relative to Galena, Triumph, and Moravian III (e.g. the barley varieties closest to C-14) is clearly demonstrated.

EXHIBIT ~~D~~ 13 supplement
MAH per letter, 19 Dec 1995

Additional Descriptive Information

per letter MAH 10-31-95

This Exhibit will provide additional information regarding variety ~~C-14~~ Moravian 14 including further biological and morphological data which clearly distinguishes it from the varieties closest thereto.

Variety C-14 is a mid-season spring two-row malting barley which is especially well suited for cultivation in irrigated growing regions of Colorado, Wyoming, Montana, and Idaho. Early seedling growth is prostrate. Tillering is similar to Galena and Triumph. Variety C-14 heads out early and is similar in maturity time to Moravian III. The plant height of variety C-14 is about equal to its parent Nairn and about 15 cm shorter than its other parent Gimpel. Variety C-14 phenotypically resembles Nairn in maturity, growth habit, and straw color, but substantially differs from Nairn in that C-14 is of a longer lax head type which is well nodded at maturity (unlike Nairn which is of an erect type). The leaves of variety C-14 are long and characteristically narrow, with the neck distance from the flag leaf to the head being very long (e.g. greater than about 10 cm). Awns are wrinkled and longer than the spike. The seed is short to midlong (e.g. about 9 mm), and has a wrinkled hull and white aleurone color. Variety C-14 kernels are small, round and very uniform in size throughout the heads thereof. Further information regarding kernel

Per letter MAH 10-31-95

characteristics is disclosed in Table 1 set forth in Exhibit B. Variety ~~C-14~~ 'Moravian 14' is higher yielding than its parents (Nairn and Gimpel). The general plant appearance of variety C-14 is readily distinguishable from Nairn and Gimpel. Specifically, variety C-14 has thin fine straw, and the flag leaf thereof is erect. Variety C-14 also has a head which is well nodded at maturity as noted above. In contrast, Nairn has orange straw at maturity which is not a characteristic of variety C-14, while Gimpel tends to lodge more than variety C-14.

In addition, the novelty of variety of C-14 with respect to its parents (e.g. Gimpel and Nairn) is further conclusively demonstrated by Restriction Fragment Length Polymorphism (hereinafter "RFLP") profiles as indicators of uniqueness. RFLP markers are detailed reflections of natural and specific variations in the DNA sequences of plant materials. These variations exist with respect to related genotypes in the form of point mutations and chromosomal rearrangements. RFLP markers are highly heritable and provide an effective method to assess the differences and similarities of genotypes based on DNA content. It should also be noted that DNA markers of the type described herein are not affected by external environmental factors, and are more consistent compared with morphological traits (e.g. phenotypic traits) which are normally used to demonstrate the novelty of a particular plant variety relative to its parents.

Applicant and Linkage Genetics, Inc. of Salt Lake City, UT have cooperated to provide RFLP profiles for variety C-14 and its

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parents (Nairn and Gimpel). These three genotypes were analyzed with 46 barley RFLP probes obtained from Dr. Andris Kleinhofs, Department of Agronomy, Washington State University, Pullman, WA using a standard RFLP protocol which is outlined as follows:

1. Plant Growth: Fifty seeds of each sample (e.g. from ~~Dt~~ 'Moravian 14' per letter 10-31-95, Nairn, and Gimpel) were planted in a 4 inch pot containing a standard horticultural potting mixture. Plants were grown for about six weeks or until 50 g of fresh leaf tissue became available. All of the plants in each pot were harvested simultaneously by clipping the plants approximately two inches above the soil surface. Harvested leaf tissue materials for each variety were thereafter placed in labelled 50 ml polystyrene tubes.

2. Lyophilization: The 50 ml tubes described in paragraph 1 were thereafter placed in a conventional lyophilizer at a temperature of -5°C. When the materials in the tubes were completely dry (e.g. after about five days), the tubes were removed from the lyophilizer, capped, and stored at -20°C.

3. Genomic DNA Preparation: DNA isolation protocols used in the procedure described herein are based on information disclosed in Saghi-Maroof, M.A., et al., "Ribosomal DNA spacer-length polymorphisms in barley: Mendelian inheritance, chromosomal location, and population dynamics", Proc. Nat. Acad. Sci. USA, 81:8014 - 8018 (1984) - copy attached hereto as Exhibit D-1.

4. Restriction Digestion of Genomic DNA: Digests were performed in accordance with standard procedures provided by GibcoBRL of Gaithersburg, MD (the manufacturer of materials used in this stage of the protocol process). These procedures involved the use of 2.5 units of DNA per μg DNA over at least a two hour period.

5. Southern Transfer: Following digestion as outlined in paragraph 4, the DNA was precipitated, resuspended, and loaded onto a neutral agarose gel. After the completion of electrophoresis in a conventional manner, the DNA in the gel was transferred onto a membrane (obtained from Micron Separations, Inc. of Westborough, MA).

6. Preparation of Radioactive Probes and Hybridization: Probing and hybridization procedures involved minor modifications of the processes published in Helentjaris, T. et al., "Restriction fragment polymorphisms as probes for plant diversity and their development as tools for applied plant breeding", Plant Mol. Biol. 5:109 - 118 (1985) - copy attached hereto as Exhibit D-2.

7. RFLP Probes and Data Scoring: The probes obtained from Dr. Andris Kleinhofs have been developed and are maintained by the North American Barley Genome Mapping Project. A list of the probes used (including chromosomal location) is provided as follows in Table 2:

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TABLE 2

Map Number	Chromosome	Probe Name	Enzyme
B10	1	ABC305	ECORI
C08	1	ABG461	HINDIII
E01	1	ABC151	HINDIII
E10	1	ABC158	ECORI
F02	1	ABG380	ECORI
F06	1	ABC310	ECORI
G01	1	ABC167	ECORV
B02	2	ABC311	HINDIII
C05	2	ABC306	ECORI
E07	2	ABC156	XBA
E09	2	ABC157	XBA
F08	2	ABC165	BAM
F10	2	ABG2	XBA
H05	2	ABG5	SST
H06	2	ABG8	SST
H08	2	ABG19	SST
CO2	2S	ABG358	ECORV
G05	3	ABC171	HINDIII
G08	3	ABC172	ECORI
H01	3	ABG389	SST
H10	3	ABC174	ECORI
H12	3	ABC176	ECORI
C01	3L	ABG377	HINDIII
A12	3S	ABG460	ECORI
B03	4	BMY1-2	HINDIII
B11	4	ABG366	HINDIII
D10	4	ADH	HINDIII
F11	4	ABG3	SST
B08	5	ICA1	XBA
C07	5	ABG373	SST
G11	5	ABG387	ECORI
B07	5S	HOR1-2	HINDIII
E12	6	ABG378	BAM
G04	6	ABC170	ECORI
G12	6	ABG388	BAM
H04	6	ABG1	HINDIII
H11	6	ABC175	HINDIII
B04	6L	AMY1	HINDIII
D01	6S	ABG466	HINDIII
C10	7	ABG463	ECORV
E06	7	ABC155	BAM
G09	7	ABG496	SST
G10	7	ABG497	HINDIII
H02	7	ABG390	ECORI
H03	7	ABG391	BAM
B09	7L	IPA	ECORI

Each RFLP probe was used in conjunction with a specific restriction enzyme. The choice of particular restriction enzymes was based on a previously-completed RFLP screen of seven barley cultivars with 96 RFLP probes and six restriction enzymes. The data generated from this screening test was evaluated to determine which enzyme revealed the most usable polymorphism with each of the selected RFLP probes.

RFLP band profiles are presented below in Table 3. Within Table 3, each restriction fragment (band) revealed by autoradiography of a membrane hybridized with a specific probe-enzyme combination was assigned a letter designation. Table 3 is as follows (see next page):

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TABLE 3

Probe	ABC156	ABC158	ABC170*	ABC171*	ABC174	ABC175	ABC305*
Enzyme	XBA	ECORI	ECORI	HINDIII	ECORI	HINDIII	ECORI
Genotype RFLP Allele Codes[1]							
Moravian 14 ~~C-14~~	BCE	CF	BEG	C	A	BC	A
GIMPEL	AC	BD	DG	CD	A	BC	AB
NAIRN	BCE	CF	BEF	CD	B	AC	B

per letter MAH 10-31-95

Probe	ABC310*	ABC311	ABG1	ABG19	ABG2	ABG373	ABG377
Enzyme	ECORI	HINDIII	HINDIII	SSTI	XBA	SSTI	HINDIII
Genotype RFLP Allele Codes							
C-14	BEFGH	BCDGHJKL	ACD	A	B	AB	C
GIMPEL	AEFH	BCDGHIJK	ACD	B	AB	AB	B
NAIRN	BCEGH	BCDGHJKL	CD	A	B	AC	C

Probe	ABG378	ABG380*	ABG387	ABG389	ABG390	ABG391	ABG461
Enzyme	BAMI	ECORI	ECORI	SSTI	ECORI	BAMI	HINDIII
Genotype RFLP Allele Codes							
C-14	AB	BCFG	A	A	C	A	CD
GIMPEL	AB	CD	A	B	B	B	CD
NAIRN	B	BFG	B	A	C	A	ACE

Probe	ABG466	ABG496	ABG497*	ABG8	AMY1*	BMY1	HOR1-2*
Enzyme	HINDIII	SSTI	HINDIII	SSTI	HINDIII	HINDIII	HINDIII
Genotype RFLP Allele Codes							
C-14	B	A	BFGHIJ	BC	ACEFGH	AB	DEF
GIMPEL	A	B	DFHIJ	AC	ABCEFG	B	BD
NAIRN	B	A	FGIJ	BC	ABCFG	AB	BDEF

Probe	IPA
Enzyme	ECORI
Genotype RFLP Allele Codes	
C-14	C
GIMPEL	C
NAIRN	A

*Probe-enzyme combinations which produce unique banding patterns for C-14 and each parent. All other combinations show banding pattern differences between C-14 and one parent.

[1]Banding patterns for each probe-enzyme combination were scored using letter codes where "A" designates the uppermost band, "B" the next lower band, etc. Codes are only comparable within each probe-enzyme combination.

Test results:

As illustrated above in Table 3, 21 of the 46 RFLP probes produced significant banding pattern differences between ~~C-14~~ Moravian 14' and one parent, while 8 probes (marked with an "*") produced unique band profiles for each genotype (e.g. different, individual band profiles for C-14, Gimpel, and Nairn.) The remaining 17 probes were monomorphic (showed no banding differences) among the three genotypes being tested.

per letter MAH 10-31-95

The eight most discriminating probes which generated unique band profiles for C-14, Gimpel, and Nairn (ABC170, ABC171, ABC305, ABC310, ABG380, ABG497, AMY1, and HOR1-2) provide clear and convincing evidence that variety C-14 is entirely unique compared with its parents (Gimpel and Nairn). The foregoing test (in combination with the other information provided above) confirms the unique nature of variety C-14, and thereby supports the issuance of a Plant Variety Certificate thereon.

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FORM APPROVED: OMB NO. 40-R3822

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
LIVESTOCK AND SEED DIVISION
BELTSVILLE, MARYLAND 20705

EXHIBIT C
(Barley)

OBJECTIVE DESCRIPTION OF VARIETY
BARLEY *(HORDEUM VULGARE)*

INSTRUCTIONS: *See Reverse.*

NAME OF APPLICANT(S)

Coors Brewing Company

ADDRESS *(Street and No. or R.F.D. No., City, State, and ZIP Code)*

12th and Ford Street
Golden, CO 80401

FOR OFFICIAL USE ONLY

PVPO NUMBER 9400115

VARIETY NAME OR TEMPORARY DESIGNATION ~~C-14~~ Moravian 14 · per let MAH 10-31-

Place the appropriate number that describes the varietal character of this variety in the boxes below.
Place a zero in first box (i.e. [0][8][9] or [0][9]) when number is either 99 or less or 9 or less.

1. GROWTH HABIT:

[1] 1 = SPRING 2 = FACULTATIVE WINTER 3 = WINTER [1] Early Growth: 1 = PROSTRATE 2 = SEMIPROSTRATE 3 = ERECT

2. MATURITY (50% Flowering):

[2] 1 = EARLY (California Mariout) 2 = MIDSEASON (Betzes) 3 = LATE (Frontier)

[3] No. of days *Earlier* than ..... [8]
[5] No. of days *Later* than ..... [2]
1 = BETZES 2 = CALIFORNIA MARIOUT 3 = CONQUEST 4 = DICKSON 5 = PIROLINE 6 = PRIMUS 7 = UNITAN 8=Moravian III

3. PLANT HEIGHT (From soil level to top of head):

[2] 1 = SEMIDWARF 2 = SHORT (California Mariout) 3 = MEDIUM TALL (Betzes) 4 = TALL (Conquest)

[1][7] Cm. *Shorter* than ..... [8]
[ ][3] Cm. *Taller* than ..... [9]
1 = BETZES 2 = CALIFORNIA MARIOUT 3 = CONQUEST 4 = DICKSON 5 = PIROLINE 6 = PRIMUS 7 = UNITAN 8=Moravian III 9=Nairn

4. STEM:

[3] Exertion *(Flag to spike at maturity)*: 1 = 0 - 3 cm. 2 = 3 - 10 cm. 3 = 10 - 15 cm. [2] Anthocyanin: 1 = ABSENT 2 = PRESENT

[0][4] NO. OF NODES (Originating from node above ground)

[2] Collar Shape: 1 = CLOSED 2 = V-SHAPED 3 = OPEN 4 = MODIFIED CLOSED OR OPEN [1] Shape of Neck: 1 = STRAIGHT 2 = SNAKY 3 = OTHER (Specify) _____

5. LEAF:

[1] Basal leaf sheath *(seedling)*: 1 = GLABROUS 2 = PUBESCENT [2] Position of flag leaf *(at boot stage)*: 1 = DROOPING 2 = UPRIGHT

[2] Waxiness: 1 = ABSENT (Glossy) 2 = SLIGHTLY WAXY 3 = WAXY [1][1] MM. WIDTH (First leaf below flag leaf)

[1][7] CM. LENGTH (First leaf below flag leaf) [2] Anthocyanin in leaf sheath: 1 = ABSENT 2 = PRESENT

6. HEAD:

[1] Type: 1 = TWO-ROWED 2 = SIX-ROWED [1] Density: 1 = LAX 2 = ERECT (Not dense) 3 = ERECT (Dense)

[2] Shape: 1 = TAPERING 2 = STRAP 3 = CLAVATE 4 = OTHER (Specify) _____ [1] Waxiness: 1 = ABSENT (Glossy) 2 = SLIGHTLY WAXY 3 = WAXY

[1] Lateral Kernels Overlap: 1 = NONE 2 = AT TIP 3 = 1/4 - 1/2 OF HEAD [3] Rachis *(Hair on edge)*: 1 = LACKING 2 = FEW 3 = COVERED

7. GLUME:

[3] Length: 1 = 1/3 OF LEMMA 2 = 1/2 OF LEMMA 3 = MORE THAN 1/2 OF LEMMA [2] Hairs: 1 = NONE 2 = SHORT 3 = LONG

[4] Hair covering: 1 = NONE 2 = RESTRICTED TO MIDDLE 3 = CONFINED TO BAND 4 = COMPLETELY COVERED

[1] Awns: 1 = LESS THAN EQUAL TO LENGTH OF GLUMES 2 = EQUAL TO LENGTH OF GLUMES 3 = MORE THAN EQUAL TO LENGTH OF GLUMES

[3] Awn Surface: 1 = SMOOTH 2 = SEMISMOOTH 3 = ROUGH

8. LEMMA:

[5] Awn: 1 = AWNLESS 2 = AWNLETS ON CENTRAL ROWS, AWNLESS ON LATERAL ROWS
3 = SHORT ON CENTRAL ROWS, AWNLETS ON LATERAL ROWS 4 = SHORT (less than equal to length of spike)
5 = LONG (longer than spike) 6 = HOODED

[4] Awn Surface: 1 = AWNLESS 2 = SMOOTH 3 = SEMISMOOTH 4 = ROUGH

[3] Teeth: 1 = ABSENT 2 = FEW 3 = NUMEROUS

[2] Hair: 1 = ABSENT 2 = PRESENT

[1] Shape of base: 1 = DEPRESSION 2 = SLIGHT CREASE 3 = TRANSVERSE CREASE

[2] Rachilla Hairs: 1 = SHORT 2 = LONG

9. STIGMA:

[2] Hairs: 1 = FEW 2 = MANY

10. SEED:

[2] Type: 1 = NAKED 2 = COVERED

[1] Hairs on Ventral Furrow: 1 = ABSENT 2 = PRESENT

[3] Length: 1 = SHORT (8.0 mm.) 2 = SHORT TO MIDLONG (7.5 - 9.0 mm.) 3 = MIDLONG (8.5 - 9.5 mm.)
4 = MIDLONG TO LONG (9.0 - 10.5 mm.) 5 = LONG (10.0 mm.)

[2] Wrinkling of hull: 1 = NAKED 2 = SLIGHTLY WRINKLED 3 = SEMIWRINKLED 4 = WRINKLED

[1] Aleurone Color: 1 = COLORLESS (White or Yellow) 2 = BLUE

[0][1] PERCENT ABORTIVE

[4][5] GMS. PER 1000 SEEDS

11. DISEASE: (0 = Not Tested, 1 = Susceptible, 2 = Resistant)

[0] SEPTORIA	[0] NET BLOTCH	[0] SPOT BLOTCH	[0] POWDERY MILDEW
[0] LOOSE SMUT	[0] BACTERIAL BLIGHT	[0] COVERED SMUT	[0] FALSE LOOSE SMUT
[0] STEM RUST	[0] LEAF RUST	[0] SCAB	[0] SCALD
[0] AY	[0] BSMV	[0] BYDV	[0] OTHER (Specify)

12. INSECT: (0 = Not tested, 1 = Susceptible, 2 = Resistant)

[0] GREEN BUG	[0] ENGLISH GRAIN APHID	[0] CHINCH BUG	[0] ARMYWORM
[0] GRASS HOPPERS	[0] CERIAL LEAF BETTLE	[0] OTHER (Specify) _____	

HESSIAN FLY RACES: [0] GP [0] A [0] B [0] C [0] D [0] E [0] F [0] G

13. CHEMICAL (0 = Not Tested, 1 = Susceptible, 2 = Resistant)

[0] DDT [0] OTHER (Specify) _____

14. INDICATE WHICH VARIETY MOST CLOSELY RESEMBLES THAT SUBMITTED:

CHARACTER	NAME OF VARIETY	CHARACTER	NAME OF VARIETY
Plant tillering	Nairn	Seed size	Gimpel
Leaf size	Nairn	Coleoptile elongation	Gimpel
Leaf color	Gimpel	Seedling pigmentation	Nairn
Leaf carriage	Nairn		

REFERENCES: The following publications may be used as a reference aid for the standardization of character descriptions and terms used in this form:

1. Wiebe, G. A., and D. A. Reid, 1961, Classification of Barley Varieties Grown in the United States and Canada in 1958, Technical Bulletin No. 1224, U.S. Dept. of Agriculture.
2. Reid, D. A., and G. A. Wiebe, 1968, Barley: Origin, Botany, Culture, Winter Hardiness, Genetics, Utilization, Pests, Agriculture Handbook No. 338, U.S. Dept. of Agriculture. pp. 61 - 84.
3. Malting Barley Improvement Association, Milwaukee, Wisconsin, 1971, Barley Variety Dictionary.

COLOR: Nickerson's or any recognized color fan may be used to determine color of the described variety.

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FEB 0 8 1984

9400115

Exhibit D

Label No. EM221405681US
I hereby certify that this paper or fee is being deposited with the U.S. Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated below and is addressed to the Plant Variety Protection Office, NAL Building, Rm. 500, 10301 Baltimore Blvd., Beltsville, MD 20705-2351

Joy Reinhart
(Printed Name)

11/29/95
(Date)

Joy Reinhart
(Signature)

IN THE U.S. DEPARTMENT OF AGRICULTURE
PLANT VARIETY PROTECTION OFFICE

In Re Plant Variety Protection)
)
Application No. 9400115)
)
Filed February 8, 1994)
)
for Barley Variety: C-14)
(Renamed Moravian 14))
)
Applicant: Coors Brewing Company)

RESPONSE

Plant Variety Protection Office
NAL Building, Rm. 500
10301 Baltimore Blvd.
Beltsville, MD 20705-2351

Dear Sir:

In a letter received from the Examiner dated 11/1/95, some additional information was requested regarding the above application. This Response will address the Examiner's requests and will provide the additional information.

On 11/21/95, Applicant's representative conducted a telephone conference with the Examiner to obtain further information on the items requested in the Examiner's 11/1/95 letter. A number of matters were discussed which will be outlined in this Response.

A. NOVELTY

Regarding the issue of novelty, the Examiner requested further information on numerous items in Applicant's Exhibit B (including a more extensive explanation of the statistical approaches associated with the data in Exhibit B). However, during the foregoing telephone interview, it was also indicated by the Examiner that the extensive genetic data provided in Applicant's original Exhibit D would be sufficient, by itself, to establish novelty if the information in Exhibit D was explicitly incorporated into Applicant's Exhibit B. Accordingly, Applicant hereby requests that original Exhibit D be redesignated for the record as being contained within and part of Exhibit B, with the information in Exhibit D being incorporated into original Exhibit B for the purpose of demonstrating novelty. If it is necessary that original Exhibit D be formally relabelled as Exhibit B, then Applicant requests that this step be taken.

As indicated above, the Examiner had previously stated that the information in Exhibit D would be sufficient, by itself, to establish novelty apart from the other data in Exhibit B. It is therefore respectfully submitted that the incorporation of Exhibit D into Exhibit B will avoid the need to provide any further statistical data involving the other information in Exhibit B. In this regard, the present application should now have sufficient evidence to demonstrate that Applicant's Moravian 14 variety is novel and entitled to protection under the Plant Variety Protection Act.

As a further note concerning the data in original Exhibit D, the Examiner stated in his 11/1/95 letter that all of the genetic information in Exhibit D must be repeated or conducted by standard published protocols. Applicant hereby confirms that the

genetic tests described in Exhibit D were, in fact, conducted using standard published protocols as outlined in the explanation provided by Applicant in Exhibit D as originally filed. An additional copy of the relevant sections of Exhibit D involving test procedures and protocols is provided as Exhibit 1 attached to this Response for the Examiner's convenience. As outlined in Exhibit 1, standard techniques were used as described in Saghai-Maroof, M. A., et al., "Ribosomal DNA spacer-length polymorphisms in barley: Mendelian inheritance, chromosomal location, and population dynamics", Proc. Nat. Acad. Sci. USA, 81:8014 - 8018 (1984) and Helentjaris, T. et al., "Restriction fragment polymorphisms as probes for plant diversity and their development as tools for applied plant breeding", Plant Mol. Biol. 5:109 - 118 (1985) both of which were provided in Exhibit D and are a part of Exhibit 1. In this regard, it is respectfully submitted that the genetic tests listed in original Exhibit D were conducted using known and established techniques.

Even though Applicant's incorporation of original Exhibit D into Exhibit B is sufficient to establish novelty in this case, Applicant will also provide supplemental information on the other tests described in Exhibit B. These other tests involve a comparative analysis of (1) Head Date; (2) Plant Height; (3) Seed Length; and (4) Seed Area as summarized in TABLE 1 on page 2 of original Exhibit B. As additional copy of TABLE 1 is included with this Response as Exhibit 2 for the Examiner's convenience. Supplemental information on the data in TABLE 1 is being provided in order to ensure that the record in this case is complete.

As a preliminary note regarding TABLE 1, Applicant wishes to provide some clarifying information at the present time. In originally-filed TABLE 1, the designation "N=8" appeared in the legend at the bottom of the table. This designation applies to

the data associated with Head Date and Plant Height, with "N=8" indicating that 2 test locations were involved with 4 replications (plots) at each location (2 x 4 = 8). Regarding Seed Length and Seed Area, an even more extensive observational analysis was conducted which was inadvertently omitted from original TABLE 1. Specifically, with respect to Seed Length and Seed Area, 2 test areas (Burley, ID and Idaho Falls, ID) were involved with 1 plot at each location (N = 2 x 1 = 2). In the Burley, ID location, 197 observations (computer determinations of Seed Length and Seed Area) were taken for Moravian 14, with 100 similar observations being taken for Moravian 14 regarding Seed Length and Seed Area in Idaho Falls, ID. Means were calculated from the observations from each location. Location means were used as replications in accordance with a 1-factor ANOVA randomized complete block design analysis. Applicant requests that this information be entered into the record at this time.

Regarding the specific numerical data in TABLE 1, the following information requested by the Examiner in his 11/1/95 letter is provided:

(1) Name of the specific statistical analysis used: As stated in TABLE 1, the listed data involving Head Date, Plant Height, Seed Length, and Seed Area was provided in accordance with a standard LSD @ 0.05 procedure. The data involving Head Date and Plant Height was analyzed in connection with conventional randomized complete block design techniques using a 2-factor ANOVA, as well as a Duncans Multiple Range Test for mean separation. Seed Length and Seed Area data was analyzed as described above using a 1-factor ANOVA randomized complete block design analysis.

(2) Evidence that the analysis was appropriate in this case: Applicant's analysis using the procedures listed above was appropriate since the resulting distribution was normal and employed standard ANOVA procedures to generate Least Significant Differences between varieties.

(3) Citation of the actual statistic and the probability value: In this regard, a protected LSD @ 0.05 probability was used in all of the analytical work associated with the replicated data in TABLE 1 on page 2 of Exhibit B.

(4) Evidence that tests were conducted in two or more localities or during two or more growing seasons: According to the Examiner's 11/1/95 letter, it was specifically requested that evidence should be provided which supports a conclusion that it was appropriate to pool the data from the performance trials conducted in 1992 at Burley, ID and Idaho Falls, ID. It was considered appropriate to pool the data in TABLE 1 involving Head Date and Plant Height (which was derived from 4 replications for each of the 2 test locations) by comparing the experimental errors from the individual locations in accordance with variance determinations based on a conventional 2-factor ANOVA. For the data in TABLE 1 involving Seed Length and Seed Area (which was derived from the Burley, ID and Idaho Falls, ID test sites with 197 observations taken at Burley, ID and 100 observations taken at Idaho Falls, ID), it was considered appropriate to pool the data in accordance with conventional practices so that more accurate and statistically-complete results could be achieved.

Again, while the supplemental information provided above regarding Exhibit B is not required to demonstrate novelty in

this case (based on the incorporation of original Exhibit D into Exhibit B), Applicant has provided the foregoing information to the best extent possible so that the record in this case will be complete.

B. BREEDING INFORMATION

The Examiner also requested specific data on the breeding history of the claimed variety (including further information involving the parental varieties of "Gimpel" and "Nairn"). Applicant has endeavored to obtain additional information on these varieties through the Germplasm Resource Information Network (GRIN) and other sources, but such information has proven to be unavailable except for a small amount of data on "Gimpel". Specifically, Applicant has learned that "Gimpel" may be identified by PI #564720 and is retained in the National Small Grains Germplasm Research Facility and Repository. Regarding "Nairn" no information was available in accordance with the investigative activities listed above (other than the fact that "Nairn" is obtainable from the Carlsberg Brewery in Copenhagen, Denmark). This variety was also discussed with the curator of the National Small Grains Germplasm Research Facility and Repository (Mr. Harold Bockelman). He was likewise unable to provide additional information on "Nairn".

With reference to the other varieties associated with the breeding of Moravian 14 (e.g. Heine 4808, Stamm.vL-P, HB-855, HB-467, and HB-8), such varieties appear to be of obscure foreign origin (e.g. from Germany or Sweden as set forth in Applicant's original Exhibit B). Applicant regrets that it is unable to locate any specific information on these varieties, most likely in view of their obscurity and foreign origin.

Finally, the Examiner requested specific information on the selection criteria used in breeding the claimed variety (e.g. Moravian 14). In this regard, the selection criteria for Moravian 14 were generally based on agronomic and malting-brewing performance, with the specific selection criteria of concern being as follows: (1) high yield; (2) early maturity; (3) seed uniformity; (4) malting quality; (5) beer flavor; and (6) lodging resistance. Additional information concerning the breeding of Moravian 14 is provided in pages 2 - 4 of Exhibit A. Furthermore, enclosed for the Examiner's consideration is a revised Exhibit A which incorporates the information provided above (e.g. see page 1 and page 5 of revised Exhibit A).

In conclusion, Applicant has conducted extensive research on the requested items, and has provided as much information as is currently available. In some cases, further information simply could not be obtained at the present time (e.g. on the variety "Nairn" as noted above). Taking all of these factors into consideration, it is respectfully believed that the information set forth above should be sufficient to complete the prosecution of this case. If the Examiner has any questions, he is invited to contact the undersigned at his convenience.

Respectfully submitted,

Jay K. Malkin
Registration No. 31,393
KLAAS, LAW, O'MEARA & MALKIN, P.C.
1999 Broadway, Suite 2225
Denver, Colorado 80202
(303) 298-9888

EXHIBIT E

All of the foregoing individuals listed above in Exhibit A (Berry J. Treat, Jody L. Treat, Paul A. Krumm, James M. Jakicic, and David J. Gebhardt) were employed by Applicant (Coors Brewing Company) during development, production, and completion of variety 'moravian 14' ~~C-14~~. By agreement with its employees, Applicant is the exclusive owner of all subject matter in the present application including but not limited to exclusive rights in and to variety C-14 as described herein. In addition, prior to the filing of this application, all of the foregoing individuals executed a written Assignment document transferring exclusive rights in the subject matter of the present application (including but not limited to variety C-14) to Applicant without reservation. The executed Assignment document is enclosed herewith for filing/recording concurrently with the filing of the present application.

per letter MAH 10-31-95

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9400115

CERTIFICATE OF TRUE COPY

STATE OF COLORADO)
) ss.
CITY AND COUNTY OF DENVER)

I, Susan L. Roberts, a Notary Public in and for said state, do certify that on February 7, 1994, I carefully compared with the original the attached facsimile of Assignment. The attached facsimile is a complete, full, true and exact facsimile of the original Assignment document.

Susan L. Roberts
Notary Public

(S E A L)

My commission expires: October 7, 1997

My address is: 1999 Broadway, Suite 2225
Denver, CO 80202